A valid and cost-effective routine monitoring of antibiotic resistance in bacteria from food animals in Switzerland is essential to prevent the transfer of resistant microorganisms through animal-derived food. An optimal and cost-effective strategy is being developed for continuous monitoring of antibiotic resistant bacteria in food animals to allow early detection of changes in resistance patterns and timely interventions.

Main results and findings

Antimicrobial resistance in bacteria from poultry A valid and cost-effective routine monitoring programme for antibiotic resistance in *Campylobacter spp.* in poultry production was achieved by randomly collecting a modest number of samples from live animals, at slaughter, and from retail. The results can be summarised as follows:

- The prevalence of *Campylobacter spp.* in live animals decreased from 2002 to 2003 but was stable in 2004 (41.6% in 2002, 24.1% in 2003 and 25.6% in 2004).
- The prevalence of *Campylobacter spp.* isolates with resistance to more than one antibiotic decreased significantly from 2002 to 2004 (8.4% in 2002, 7.6% in 2003 and 3.7% in 2004).
- The prevalence of *Campylobacter spp.* in cloacal swabs of live animals was 33% (mean of the years 2002 and 2003), in neck skin samples from slaughter was 11% (mean of the years 2002 and 2003), and in meat samples was 22% (year 2002).
Significant differences in resistance patterns between Campylobacter spp. from Swiss meat (less likely to be resistant) compared to imported products (more likely to be resistant) were found for ciprofloxacin, ampicillin and tetracycline.

Type of production was also associated with antimicrobial resistance; that is, Campylobacter spp. isolates from meat labelled as animal-friendly were less likely to be resistant than isolates from conventional production.

In 2005, the resistance monitoring was expanded to Enterococcus spp. and E. coli, with following results:

- Among the 559 E.coli isolates, resistance to tetracycline, sulfonamides and streptomycin was most frequent, and 43% of the isolates were resistant to more than one of the tested antibiotics.
- Among the 188 Enterococcus spp. isolates, resistance to tetracycline and erythromycin was frequent, 3% (5 isolates) were resistant to vancomycin, and 74% of the isolates were resistant to more than one of the tested antibiotics. However, no co-resistance to penicillin, tetracycline and erythromycin was found.

Antimicrobial resistance in bacteria from pigs

To assess the prevalence of resistant bacteria in 60 pig breeding farms (period November 2004 to June 2005), the Monte Carlo simulation model was adapted to pigs. Since E. coli isolates within the same pooled sample had various resistance patterns, the precision of the estimate, i.e. for tetracycline resistance, was substantially improved by increasing the number of animal tested per farm, or the number of E. coli isolates per pig. It was found that resistance patterns of E. coli from pigs were similar to E. coli from poultry. Furthermore, compared to traditional farms, a decrease in antibiotic resistance in Campylobacter isolates from the faeces of Swiss “animal-friendly” pig fattening farms (both in reduction of resistance to fluoroquinolones as well as reduction in the number of isolates with multiple resistances) was observed.

Antimicrobial resistance in bacteria from cattle

In 2005, fresh beef was sampled at retail. A low prevalence of Campylobacter (among 110 samples, none was positive) and indicator bacteria (among 320 samples: 2 isolates (0.63%) positive for E. coli, both streptomycin resistant, and 3 (0.94%) positive for Enterococcus spp., no resistant isolates) was observed.

Genetic diversity in a Campylobacter jejuni and Campylobacter coli population isolated from Swiss poultry

From 100 randomly selected flocks, 5 live birds per flock (at delivery at the abattoir) were selected. The samples were analysed using three independent typing methods: AFLP (whole genome), flaA-RFLP (polymorphism in a single gene) and phenotypic determination of resistance (disk diffusion) to 8 antimicrobial agents commonly used in veterinary and human medicine. The results can be summarised as follows:

- The Campylobacter population in Swiss poultry is genetically highly diverse, and genetic typing by AFLP or flaA-RFLP was complementary.
- No correlation between genotype and resistance pattern was observed, suggesting that antimicrobial resistance is more variable (sketching the high adaptive potential of Campylobacter against antimicrobial pressure) than the combined AFLP/flaA-RFLP genotype.
- Sulphonamide resistance was frequently found together with streptomycin resistance, and further experiments are required to assess a potential genetic linkage.

Phenon cluster analysis for investigation of relatedness between Campylobacter sources

To assess the possible epidemiological significance of possible infection sources for human campylobacteriosis, fluorescent AFLP was used to type 243 apparently epidemiologically unrelated C. jejuni isolates (77 humans, 46 cattle, 49 pets and 71 poultry). The results showed that:

- Isolates from different sources were frequently clustered together, underlining the high degree of source mixing and the lack of host specificity of C. jejuni.
- A high degree of relatedness between animal and human isolates was observed, indicating the importance of animals as infection source of humans.
Publications of the NRP 49 project


Publications for the general public

Regula G.
Antibiotikaresistenz.

Ledergerber U, Knopf L.
Neue Überwachungsprogramme vorgereitet.

Ledergerber U.
Antibiotikaresistenzen intensiver überwachen.

Regula G.
Antibiotikaresistenz.

Stärk KDC, Regula G.

Ledergerber U.
Antibiotikaresistenzen bei Mastschweinen.

Stärk KDC.
Bakterielle Antibiotikaresistenz im Veterinärbereich.

Arbeitsgruppe Zoonosen.
Antibiotika-Resistenz.

Breidenbach E.
Antibiotika-Resistenz – Wie steht es bei den Nutztieren?